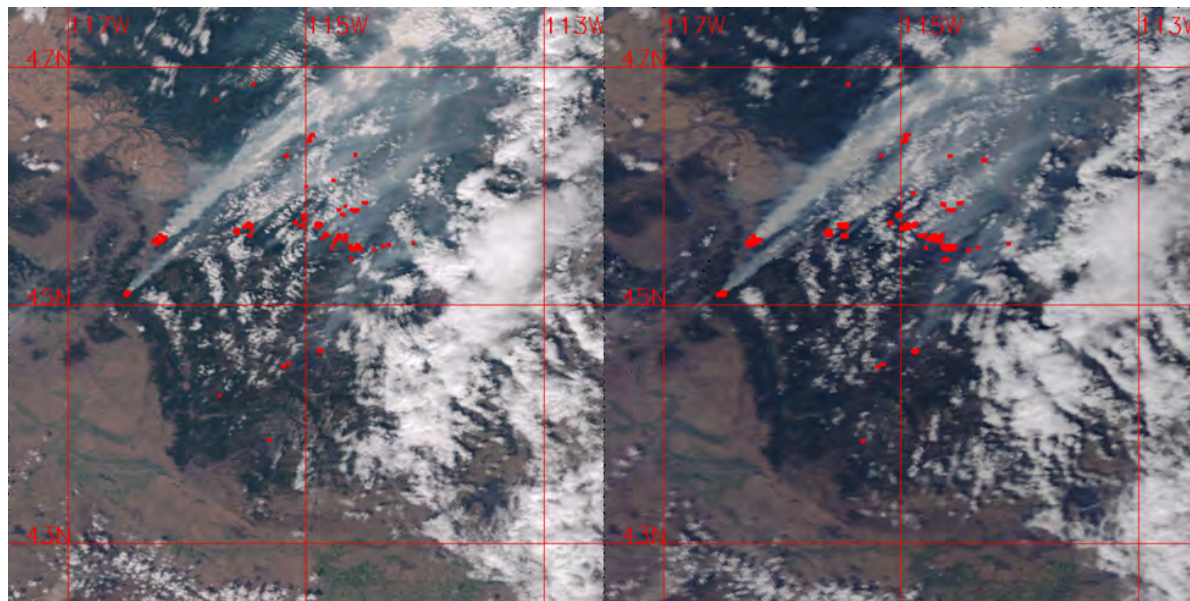




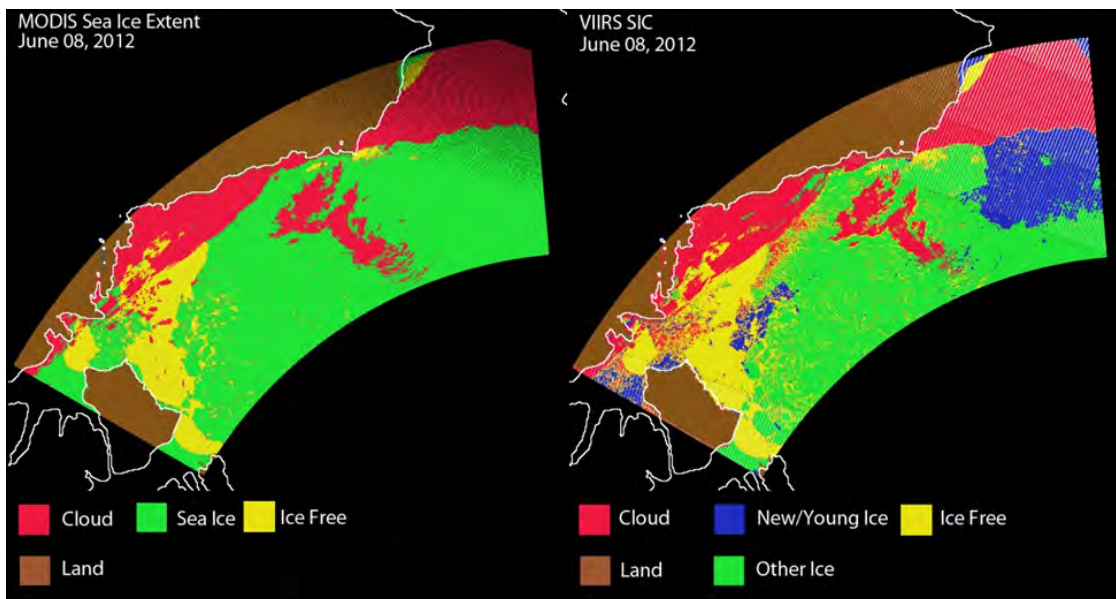
Land and cryosphere products from Suomi NPP VIIRS: Overview and Status

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◀ **Figure 1:** Comparison of Suomi-NPP VIIRS (left) and EOS-Aqua MODIS (right) fire detections on 9 September, 2012 in the Western US (ID, MT, WY).

Figure 2: MODIS Sea Ice Extent (Left) and S-NPP VIIRS Sea Ice Characterization (Right) for 8 June, 2012 over the Beaufort Sea.





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Abstract: The Visible Infrared Imaging Radiometer Suite (VIIRS) instrument was launched in October 2011 as part of the Suomi National Polar-orbiting Partnership (S-NPP). The VIIRS instrument was designed to improve upon the capabilities of the operational Advanced Very High Resolution Radiometer (AVHRR) and provide observation continuity with NASA's Earth Observing System's (EOS) Moderate Resolution Imaging Spectroradiometer (MODIS). Since the VIIRS first-light images were received in November 2011, NASA and NOAA funded scientists have been working to evaluate the instrument performance and generate land and cryosphere products to meet the needs of the NOAA operational users and the NASA science community. The NASA S-NPP Science Team has focused on evaluating the NOAA operational products (known as Environmental Data Records, or EDRs) produced by the NESDIS Interface Data Processing Segment (IDPS), developing and testing additional products to meet science data needs and providing MODIS data product continuity. The latter two functions are performed by the NPP VIIRS Land Product Evaluation and Algorithm Test Element (PEATE) in GSFC Code 619.

This work presents to-date findings of the NASA Science Team's evaluation of the VIIRS Land and Cryosphere EDRs, specifically Surface Reflectance, Land Surface Temperature, Surface Albedo, Vegetation Indices, Surface Type, Active Fires, Snow Cover, Ice Surface Temperature, and Sea Ice Characterization. The study concludes that, for MODIS data product continuity and earth system science, an enhanced suite of Land and Cryosphere products and associated data system capabilities are needed beyond the EDRs currently available from the VIIRS. There are also a number of land standard products from MODIS which are not currently generated by NOAA's Interface Data Processing Segment's (IDPS) or planned for IDPS production (i.e. LAI/FPAR, Net Primary Productivity, Vegetation Dynamics (phenology), Vegetation Continuous Fields, and Burned Area). If NASA MODIS product continuity is to be maintained, these products will need to be generated. At the same time, both earth system science and remote sensing methods are advancing and additional global products could be considered e.g. Evapotranspiration, Forest Cover Change, and Crop Type. Similarly, although there has been considerable investment in regional ground station, Direct Read-Out capability from VIIRS, there is a strong interest from the science and applications communities to obtain global VIIRS data in near real-time with the functionality of the NASA Land Atmosphere Near real-time Capability for EOS (LANCE).

References: Justice, C.O., Román, M.O., Csiszar, I., Vermote, E., Wolfe, R., Hook, S.J., Friedl, M., Wang, Z., Schaaf, C., Miura, T., Tschudi, M., Riggs, G., Hall, D.K., Lyapustin, A., Devadiga, S., Davidson, C., & Masuoka, E. (2013). Land and Cryosphere Products from Suomi NPP VIIRS: Overview and Status. *Journal of Geophysical Research-Atmospheres*, 118, 1-13, [doi:10.1002/jgrd.50771](https://doi.org/10.1002/jgrd.50771).

Data Sources: Data from the [VIIRS Land Product Evaluation and Analysis Tool Element's \(Land PEATE\)](#) archive sets (AS) 3001, (products generated by the Land PEATE using the IDPS software), and AS 3002 (products generated by the Land PEATE using NASA Land Science Team adjusted versions of the IDPS software) were used in the evaluation of the VIIRS EDRs. The improvements performed as part of AS 3002 included algorithm improvements, bug fixes and look-up table updates. In most cases, these adjustments were implemented months before they transitioned into operational production in the IDPS (AS 3001).

Technical Description of Images: **Figure 1:** The VIIRS Active Fires Application Related Product (ARP) was built on the EOS MODIS Collection 4 Fire and Thermal Anomalies algorithm. The main tests designed to identify fire-affected pixels in the image swath data mimic the MODIS algorithm with no specific tuning or consideration of unique spectral and/or spatial characteristics involving the primary VIIRS fire channels used (i.e., the 3.9-4.1 μ m [M13] and 10.2-11.2 μ m [M15] bands). In comparing VIIRS with MODIS Aqua (similar overpass times) the primary driver of differences in the products is related to spatial sampling. There are differences in pixel size, along scan line aggregation schemes, and line spread function. A comparison of Suomi NPP VIIRS (left) and Aqua MODIS (right) fire detections on 9 September, 2012 at 19:55 and 20:15 UTC respectively, show the Wesley, Sheep, McGuire, Porcupine, Mustang, Halstead and Trinity Ridge fires in the Western U.S. **Figure 2:** The VIIRS Sea Ice Characterization (SIC) EDR consists of an ice age classification map that contains classifications for 'Ice-free', 'New/Young Ice' and 'All Other Ice' categories. 'New/Young Ice' has a maximum thickness of 30cm, while 'All Other Ice' is thicker than 30cm. The EDR does not include fresh-water ice and may also exclude some shore-fast ice areas, depending on the land mask used. It is produced both day and night over the oceans. For the SIC EDR daytime branch of the algorithm during the melt season, misclassifications occur when the lower reflectance of melting sea ice appears to cause the SIC EDR to indicate New/Young Ice, although this type of ice cannot be present this time of year. Nonetheless, the distribution of ice and ice-free areas compares well with the MODIS sea ice extent in this example.

Scientific significance: To achieve the stated goal of MODIS data continuity and the establishment of long-term data records through VIIRS, it is important to start now to use S-NPP to establish a pathway to science use of VIIRS data in the JPSS era. One year after launch, initial instrument and operational product evaluations are now ending and the next step is to build on the success of the [MODIS Adaptive Processing System \(MODAPS\)](#) and the [VIIRS Land PEATE](#) data processing and generate and distribute high quality land and cryosphere products from the beginning of the VIIRS data record and with the capability of subsequent reprocessing, to meet the needs of the land science and applications communities.